

Appl. No. : 10/025,310 Marked up amended specification  
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U.S. Patent Document Cited:

U.S. Patent No. 3,629,600: EMERGENCY TRAFFIC LIGHT CONTROLLER

U.S. Patent No. 3,933,354: REFLEX TESTING AMUSEMENT DEVICE

U.S. Patent No. 4,702,475: SPORTS TECHNIQUE AND REACTION TRAINING  
SYSTEM

U.S. Patent No. 5,325,340: PACING DEVICE

U.S. Patent No. 5,812,239: METHOD AND ARRANGEMENT FOR THE  
ENHANCEMENT OF VISION AND/OR HAND-EYE COORDINATION

U.S. Patent No. 5,897,457: ATHLETIC PERFORMANCE MONITORING SYSTEM.

U.S. Patent No. 6,066,105: REFLEX TESTER AND METHOD FOR MEASUREMENT

U.S. Patent No. 6,287,378 B1: PERFORMANCE AND ENTERTAINMENT DEVICE  
AND METHOD OF USING THE SAME

1 SPECIFICATION

2 TITLE OF INVENTION

3 Method and device for introducing state changes into athletic activities.

4 CROSS-REFERENCE TO RELATED APPLICATIONS

5 Not Applicable.

6 STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR

7 DEVELOPMENT

8 Not Applicable.

9 REFERENCE TO SEQUENCE LISTING , A TABLE, OR A COMPUTER PROGRAM

10 LISTING COMPACT DISK APPENDIX

11 Not Applicable.

12 BACKGROUND OF THE INVENTION.

13 Most athletic activities require the participants to respond rapidly to changes in  
14 their environment. For instance, they must constantly reevaluate their course of action  
15 depending upon their own velocity and position and that of a ball, opposing players, and  
16 teammates. However in training, and especially in solo training, the environment tends to  
17 be largely static. In the game known as soccer in the U.S.A, and football elsewhere, a  
18 common training drill consists of a player dribbling a ball around a series of cones or  
19 other similar markers. Such variation as exists consists of predetermined decisions such  
20 as to alternate between passing on the left on one cone and on the right on the next.  
21 Effectively such training exists within an invariant environmental state.

1           The disadvantage of such a drill is that it does not train athletes to constantly  
2 observe, analyze, and react, as they must in a real game. The present invention allows  
3 the introduction of transitions between multiple environmental states, such transitions  
4 being either strictly periodic or randomly varying in frequency, enabling in training  
5 situations a better simulation of the timing and thought processes of the game in question.  
6 The invention also allows new types of games to be created and played which incorporate  
7 the varying states expressed by the device into the play of the game. The invention  
8 accomplishes these goals by maintaining a time varying internal state which is transmitted  
9 to athletes, typically via a visual method such as colored lights, so that the athletes may  
10 interpret these signals as a change in the training or game environment. In the soccer  
11 training drill the invention would replace the traditional practice cone and would indicate  
12 to the player the manner in which the ball should be passed around the obstacle.

13           The intentional introduction of transitions between multiple contest states is  
14 common in arcade and video games and other electronic entertainment but there is little  
15 precedent for this in athletics. The only common examples occur at or before the actual  
16 contest: the opening toss of a coin before a game or the drop of the flag in an automobile  
17 race. In music the periodic signal from a metronome is often used and there may be  
18 instances where the signal from such a metronome has been used to aid athletes  
19 synchronize their movements to music. That differs from the utility of the present  
20 invention, which is not synchronization, but the presentation of varying training or game  
21 states to the athlete.

1 The following U.S. patents disclose concepts that bear some relation to the present  
2 invention. However, none of the cited prior art discloses an invention having the  
3 versatility or utility of the present invention.

4 Stuler U.S. Pat. No. 3,629,600 discloses a battery powered traffic light controller.  
5 This and other traffic controllers differ markedly from the device of the current patent  
6 application. Such controllers transition between their 3 states (green, yellow, red) in a  
7 single fixed order. Additionally, these transitions are either triggered by external sensors  
8 or occur at fixed time intervals. The present invention does not use external sensors to  
9 trigger state transitions. Instead, a large repertoire of randomly varying state transitions  
10 useful in athletic training is provided. The traffic controllers would be predictable and  
11 useless for injecting variation into athletic training. Conversely, the device of the present  
12 patent, when configured appropriately for athletic training, would lead to havoc if utilized  
13 as a traffic controller.

14 Ramsey U.S. Pat. No. 5,325,340 discloses an athletic training device which is  
15 utilized for pacing. Its function is the antithesis of that of the device of the present patent  
16 application. The pacing device produces a certainty. It tells the athlete exactly where to  
17 be at a given time and even goes so far as to provide a correction signal when the athlete  
18 is too far ahead or behind. The present device produces an uncertainty. Its purpose is to  
19 present a signal which is variable and unpredictable. Moreover, the feedback circuit of  
20 Ramsey's device requires a measurement of the athlete's position. No such measurement  
21 is required or supported by the present invention.

1 Goldfarb et al. U.S. Pat. No. 3,933,354 discloses a martial arts amusement device  
2 in which a light at one of ten positions on a picture of a combatant is lit. When a player  
3 strikes that position the light turns off, the player's score is incremented, and the game  
4 lights another region on the simulated combatant. The lights are selected from a pattern  
5 sufficiently complex to appear in random order to the player. This is a one or two player  
6 game. This invention is primarily a game rather than a serious athletic training device  
7 and it is described in very narrow terms without any general application to other types of  
8 athletic training or contests. This invention requires constant input from the player - the  
9 game will lock in any device state where a lamp is lit unless the player strikes the lit part  
10 of the display to allow it to transition to the next state. The designers recognized that a  
11 detector failure would render the game inoperable and provided a failsafe mechanism to  
12 transition should that occur - but such a transition is not a normal operating mode of the  
13 invention. In comparison, the invention of the present patent application, as it might be  
14 implemented for martial arts practice, would have lit one or more lamps for short periods  
15 of varying duration during which a lit lamp would have been a target for the athlete. The  
16 device would then have transitioned to another device state whether or not the athlete  
17 succeeded in striking the target.

18 Elstein et al. U.S. Pat. No. 4,702,475 disclose a sports technique and reaction  
19 training system in which a particular movement pattern is to be executed by the  
20 participant in a given amount of time in response to a start signal that determines which  
21 of several such patterns is to be executed. This invention requires that the participant

1 return to a base position to trigger another training cycle - so that the time required to  
2 complete the movement pattern may be measured. Moreover, the purpose of the  
3 invention is to train the participant to carry out a choreographed set of motions in  
4 minimal time. The present[[-]] invention is very different. Some of the differences are:  
5 the position of the athlete with respect to the device is not fixed (there are no intrinsic  
6 start and stop positions); the device runs independently of the athlete's actions (other than  
7 setting it and turning it on, the athlete would not normally affect the state of the device);  
8 more than one device could be simultaneously employed in training or during a game by  
9 an athlete or athletes; and the utility of the invention is to provide state transitions in  
10 training to better simulate actual play, or in play, to provide more variety to the game, but  
11 not to improve the performance of a predetermined choreographed set of motions.

12 Other instances of the class of athletic measurement devices examined in detail in  
13 the preceding paragraph are disclosed in Mackovjak U.S. Pat. No. 5,897,457, Guillen  
14 U.S. Pat. N. 6,066,105, and Feiner et al. U.S. Pat. No. 6,278,378. These devices all differ  
15 from the present invention in requiring two trigger events: one to initiate a measurement  
16 and a second one to indicate its termination. The devices then report the performance in  
17 some manner. The present invention utilizes no triggers, does not measure performance  
18 in any way, and is used in an altogether different manner than any of these devices.

19 Eger U.S. Pat. No. 5,812,239 discloses a visual training device comprising a  
20 plurality of LEDs under microprocessor control, and in some embodiments, sensors and  
21 additional optics. In all embodiments the user stands at a fixed position with respect to

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1 the device and looks at LEDs as they are lit. In some variations of this embodiment the  
2 user is further required to peer through special optics at the same time. This may be an  
3 exemplary eye training device of utility in an optometrist's office. However, a person  
4 standing in a fixed position and rolling her eyes is not generally considered to be either  
5 training for, or participating in, an athletic endeavor. Most critically in its most basic  
6 form this device neither elicits nor allows significant bodily motion and consequently has  
7 little utility in athletic training. The more active embodiments disclosed are designed to  
8 measure reaction time in response to the same visual stimulus. As such, these require at  
9 least one sensor, which acts as a trigger, and as described above for other similar  
10 measurement devices, differ in fundamental ways from the present invention.

11

1 BRIEF SUMMARY OF THE INVENTION

2 This ~~invention~~ device is to be employed in the training of athletes and the playing  
3 of athletic games. During these activities athletes observe and respond to signals that  
4 vary with time and are generated and displayed by the ~~invention~~ device. In this manner  
5 the ~~invention~~ device adds a new element to athletic training and enables new types of  
6 sports to be played.

7 SUMMARY OF THE INVENTION

8 The present ~~invention~~ device provides for one or more logical states to be  
9 continuously varied, either periodically or randomly, and for this state information to be  
10 transmitted to one or more athletes for the purpose of varying the training or game  
11 environment. The athlete would perceive this information either visually or aurally as  
12 appropriate for each sport. For a specific example consider again the soccer drill  
13 described above. ~~The~~ This device ~~in this case~~ would either adorn or replace the typical  
14 cone marker and would maintain an integer variable ~~via electronic, mechanical, optical,~~  
15 ~~or other means two binary variables~~ which would transition between ~~their On and Off~~ its  
16 four allowed <sup>contradict?</sup> states in a periodic, random, or pseudorandom pattern. This information  
17 would be conveyed to the athlete visually - for instance, by providing two rings of light  
18 around the cone, one blue, one red, which are lit according to the value of the matching  
19 state variable. Together these two state variables would encode four device states with  
20 the local (to this cone) meanings "Pass on Left", "Pass on Right", "Pass on Left or Right",  
21 and "Do not Pass". The time fraction the device spends in each state would be



1 adjustable, as would be the mean frequency of the transitions between these device states  
2 and the minimum hold time spent in each device state before a transition ~~was~~ would be  
3 permitted. An athlete approaching the cone would observe the state of the device and  
4 respond as appropriate. Even this simple four state training device could easily be  
5 employed in numerous other drills in this and other sports. For instance, the same four  
6 state device placed at the top of the basketball key could indicate "left side layup", "right  
7 side layup", "shoot from the top of the key", or "shoot immediately." In baseball it might  
8 tell a pitcher to throw a curve, slider, fastball, or to throw out the runner at first base. The  
9 invention may also be used to globally alter the rules of the athletic contest or practice.  
10 Examples: "when the red light is lit players may not shoot on goal" or "player number 5  
11 may shoot".

#### 12 BRIEF DESCRIPTION OF THE DRAWINGS

13 The manifestation of the present invention will necessarily vary depending upon  
14 the particular sport ~~it is applied to~~. This is particularly true when considering aquatic  
15 versus terrestrial playing environments. To illustrate this invention a preferred  
16 embodiment is presented for use in the context of a terrestrial game like soccer.

17 ~~Figure 1 shows the exterior of the invention as viewed from the side.~~

18 ~~Figure 2 shows a block diagram of the mechanism.~~

19 Figure 1 Side view of the exterior of the preferred embodiment.

20 Figure 2 Block diagram of the mechanism of the preferred embodiment.

1 Figure 3A. Block diagram of a line powered remote controller with microphone,  
2 speaker, and transmitter receiver.

3 Figure 3B. Block diagram of a display unit with microphone, speaker, symbolic  
4 display, and transmitter receiver.

5 Figure 4A. Alphanumeric display unit worn by athlete.

6 Figure 4B. Alphanumeric display unit attached to a piece of sports equipment.

7 Figure 5. Multiple display units with a single remote controller.

8  
9 Reference Numerals Used in the Drawings:

10 10. Ring of Red Light Emitting Diodes

11 20. Ring of Blue Light Emitting Diodes

12 30. Plastic Cone

13 40. Removable Battery

14 50. Controller

15 60. Power Switch

16 70. Frequency Dial

17 80. Hold Time Dial

18 90. DIP Switch DP1

19 100. DIP Switch DP2

20 110. Line Power

21 120. Speaker

- 1    130. Microphone
- 2    140. Transmitter receiver
- 3    150. Symbolic Display
- 4    160. Alphanumeric Display
- 5    170. Wearable case.
- 6    180. Attachable case.
- 7    190. Article of sporting equipment.
- 8    200. Athletic field with a plurality of display units
- 9    210. Current Device State of Remote Controller
- 10   220. Remote Controller
- 11   230. Display state.
- 12   240. Athlete
- 13   250. Transmission from remote controller to display units
- 14   260. Display unit
- 15   270. Communications selector
- 16   280. Previous Device State of Remote Controller

17  
18   DETAILED DESCRIPTION OF THE DRAWINGS.

19        Figure 1 is a drawing of the exterior of the preferred embodiment of the invention.  
20        There are two rings of colored ~~LEDs~~ light emitting diodes (LEDs) on the device, a red  
21        one located near the cone's tip **10** and a blue one **20** located near the middle of the cone

1 ~~20~~. The remainder of the exterior of the device is composed of a strong and durable  
2 plastic case 30 in a contrasting color such as yellow or light orange ~~30~~.

3 In this description the term "device state" refers to the value maintained by the  
4 device of a specific integer number which is encoded by at least one bit. In this first  
5 embodiment this integer has two bits and so the device state can takes one of four values.  
6 A transition is when the device state takes any of the four allowed values, including the  
7 one it had previously. The device "changes state" when it moves from one of these four  
8 allowed values to a different allowed value.

9 Figure 2 shows a block diagram of the mechanism. A removable battery 40  
10 provides power ~~40~~. It is connected to a small ~~electronic module~~ controller 50. This  
11 ~~module~~ is a typical embedded microprocessor based controller that reads its program  
12 from internal read only memory. When power is applied via an ON/OFF switch ~~80~~ 60,  
13 and at one second intervals thereafter, the controller reads the desired device settings  
14 from the configuration devices, two dials ~~100, 110~~, 70, 80 and ~~from~~ a pair of 8 position  
15 DIP switches DP1, DP2 ~~120, 130~~ 90, 100, and uses its internal program, the value of the  
16 device state, and this setting information to drive ~~the blue 60 and red 70 sets of display~~  
17 ~~LEDs (also Figure 1 10, 20)~~ the red 10 and blue 20 sets of display LEDs. ~~Dial 1 100~~ The  
18 Frequency Dial 70 controls the mean frequency at which the device ~~changes~~ may change  
19 state, which can be varied between 600 transitions per minute and 0.1 transitions per  
20 minute. ~~Dial 2 110~~ The Hold Time Dial 80 sets the minimum hold time a device state  
21 must be maintained before a state transition is allowed and is variable between 200

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1 milliseconds and 5 minutes. The switches on DP1 **90** and DP2 **100** ~~(120 and 130)~~  
2 control the device in the following manner:  
3 DP1,0 determines if the transitions are periodic (fixed rate) or randomly varying around a  
4 mean frequency.  
5 DP1,1 determines the device state ~~transition~~ order as sequential {0,1,2,3,0...} or random.  
6 DP1,2-4 determine the occupancy for device state 0  
7 DP1,5-7 determine the occupancy for device state 1  
8 DP2,0-1 unused  
9 DP2,2-4 determine the occupancy for device state 2  
10 DP2,5-7 determine the occupancy for device state 3

11

12 The occupancy values set on DP1 **90** and DP2 **100** are integers in the range 0  
13 through 7. The total occupancy for the system is the sum of the four device state  
14 occupancies. For instance, if these values were 0,5,3,2 (for states 0 through 3,  
15 respectively) the device would never enter state 0, would spend 50% of its time in state 1,  
16 30% in state 2, and 20% in ~~state 1~~ state 3. To vary only between states 1 and 2, and spend  
17 equal time (on average) in each the setting would be 0,N,N,0 where N is between 1 and 7.  
18 ~~When used in the soccer dribbling drill application a typical setting might be: random~~  
19 ~~transitions with a mean frequency of 15 transitions per minute, a minimum hold time of~~  
20 ~~.5 seconds, random transition order, and occupancies set to 2,7,7,2.~~ It is assumed that

1 situations will arise where the invention will also be used as a static marker in fixed state.

2 To lock the device into state 2 the occupancy values would be set at 0,0,7,0.

3 When used in the soccer dribbling drill application a typical setting might be:

4 random transitions with a mean frequency of 15 transitions per minute, a minimum hold

5 time of .5 seconds, random ~~transition~~ device state order, and occupancies set to 2,7,7,2.

6 The mean period (MP) is the inverse of the mean frequency. Here the hold time (HT) of

7 0.5s is less than the MP of 4s, so a random number (RN) valued in seconds between 0

8 and  $2*(MP-HT)$ , here 7s, is generated by the controller. The next transition is then

9 calculated at  $HT + RN$  seconds later. If HT had been more than MP the time offset to the

10 next transition would have been equal to MP. When a transition is determined a second

11 random number between 1 and 18 (the total occupancy) is generated by the controller.

12 The next device state is then determined by this random value as follows: 0 for {1,2}, 1

13 for {3,4,5,6,7,8,9}, 2 for {10,11,12,13,14,15,16}, 3 for {17,18}.

14 ~~The table below~~ Table 1 shows the states of the signal lights and their

15 interpretation by the athlete. The first column indicates the state of the red LEDs, the

16 second column the state of the blue LEDs, the third column the device state, and the

17 fourth column ~~indicates~~ the interpretation of the device state to be made by the athlete

18 within the context of a soccer dribbling drill.

19 TABLE 1

Red Lights	Blue Lights	Device State	Meaning to player
off	off	0	Do not pass
on	off	1	Pass on right side

new?

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off	on	2	Pass on left side
on	on	3	Pass on either side

Figure 3A shows a block diagram of an alternative embodiment where the remote controller comprises a line power source 110 and switch 60, electronic controller 50, Frequency 70 and Hold Time 80 Dials, two DIP switches 90, 100, speaker 120, and microphone 130. These are physically separate from the display unit described below in Figure 3B and communicate with it via a transmitter receiver 140. The logical operation of the device is as described above except that the controller 50 in this embodiment also acts to record and transmit sounds detected by the microphone 130 through the transmitter receiver 140, and to play sounds received through the transmitter receiver 140 on the speaker 120.

Figure 3B shows a block diagram of an alternative embodiment of the display unit, comprising a battery power source 40 and switch 60, speaker 120, microphone 130, symbolic display 150, and a transmitter receiver 140. The components act substantially as described above except that the controller 50 in the display unit, known as the display controller, simply relays the device state information of the remote controller of Figure 3A to the symbolic display 150, which replaces the LED rings of Figure 1 and Figure 2. The four device states of Table 1 would be displayed here as symbols, one of which is shown in the figure, indicating by the left arrow that the player must go left.

A second embodiment utilizes exactly the same configuration shown in Figures 3A and 3B but with different programs loaded in the controller and display controller. In

1 this variation the device state is maintained by the display controller in the display unit.  
2 The controller in the remote controller serves primarily to read the configuration devices  
3 and to pass those settings to the display unit. When acting in this lesser capacity the  
4 remote controller will be referred to as a remote control. The multiple display unit device  
5 illustrated in Figure 5 is described below only with a remote controller because the  
6 remote control variation requires no hardware changes, only reprogramming of the  
7 controller.

8 Figure 4A shows an alternative embodiment of the display unit as a device  
9 wearable by the athlete. This device is logically identical to the embodiment of Figure 3B  
10 except that the symbolic display 150 has been replaced by an alphanumeric display 160.  
11 That is, instead of a left arrow the alphanumeric display 160 shows text, in the figure,  
12 "Pass on Left". A wearable case 170 in this embodiment allows the athlete to don the  
13 device, which, of course, could also be carried. The design of the case will necessarily  
14 vary considerably from sport to sport. Here the case 170 is shown fastened to the athlete's  
15 wrist.

16 Figure 4B shows an alternative embodiment of the display unit as a device  
17 attached to an article of athletic equipment 190. The exact design of the attachable case  
18 180 will necessarily vary with the type of equipment it is to be attached to. Here the case  
19 shown is substantially the same as the wearable case 170 of Figure 4A, which being  
20 suitable for attachment to a wrist, will also be suitable for attaching to cylindrical  
21 equipment of roughly the same diameter as a human wrist.



1 Figure 5 shows an alternative embodiment where a plurality of display units 260  
2 are arrayed on an athletic field 200 and are controlled from a single remote controller 220.  
3 In the training exercise illustrated the athlete 240 moves to guard the single blue lit  
4 display unit and ignores any other lit display units. Externally each display unit 260  
5 resembles the entire device of Figure 1 and comprises a ring of red LEDs 10, a ring of  
6 blue LEDs 20, a durable plastic case 30, and an additional component, a transmitter  
7 receiver 140. Internally the display units are logically essentially as described in Figure  
8 3B, in this instance with the minor substitution of rings of LEDs 10,20 for the symbolic  
9 display 150 of Figure 3B.

10 The display state 230 of each display unit 260 corresponds to a portion of the  
11 device state 210 of the remote controller 220. For this illustration the current device state  
12 210 of the remote controller 220 is presented as 9 values of 2 bits each and their 1:1  
13 correspondence via the logic of Table 1 to the current display state 230 of the various  
14 display units 260 is evident. The preceding device state 280 is also shown. In the  
15 preceding moment the central display unit was blue. Following a device state change the  
16 athlete is moving to guard the display unit which is currently blue, having ignored in both  
17 instances the single red display unit. The device state is transmitted 250 via the  
18 transmitter receiver 140 to the plurality of display units on the field 200, each of which  
19 then takes on the display state 230 which corresponds to its portion of the device state  
20 210. There are numerous well known methods available for dynamically mapping parts  
21 of the device state 210 to particular display units 260. In this simple embodiment static

mapping is employed: this information is set in the controller inside each display unit at the time of manufacture.

The remote controller 220 is essentially the same as that shown in Figure 3A, with a few minor enhancements to allow it to control more than one display unit at a time. One possible arrangement of the exterior features is presented showing the speaker 120, microphone 130, power switch 60, transmitter receiver 140, and the configuration devices. The configuration devices include the Frequency dial 70, Hold time Dial 80, DIP switches DP1 90 and DP2 100, and the large DIP switch which is the communications selector 270. Several training options programmed into the controller provide a variety of exercises. To toggle between these modes the previously unused DIP switches DP2,0 and 1 are now employed to set the controller as described in Table 2.

TABLE 2

<u>DP2,0</u>	<u>DP2,1</u>	<u>Device State</u>
<u>open</u>	<u>open</u>	<u>All display units transition together to the same state.</u>
<u>closed</u>	<u>open</u>	<u>Each display unit transitions independently</u>
<u>open</u>	<u>closed</u>	<u>Display units transition sequentially</u>
<u>closed</u>	<u>closed</u>	<u>Cycle between preprogrammed sequential actions</u>

The first of these modes is equivalent to a single device of Figure 1 reflected on the field multiple times. The second mode is equivalent to the deployment on the field of multiple independent instances of the device of Figure 1. The third mode activates display units sequentially in a predefined or random order so as to present a localized signal that moves in a one, two, or three dimensional pattern across a playing area. As in

1 the device of Figure 1, the randomly timed transitions prevent the athlete from predicting  
2 the moment when the next change will occur. In Figure 5 the athlete on the field moves  
3 to "guard" the single blue cone, where the order in which the cones are lit simulates the  
4 erratic motions of a moving offensive player. The fourth mode cycles slowly through the  
5 activation patterns which are available for the third mode. The controller stops cycling,  
6 locking in the current pattern, when DP2,0 is set back to the open.

7 The communications selector (CS) 270 is read by the controller in a manner  
8 similar to the other DIP switches. The CS allows communications to be selectively  
9 targeted to any subset of the display units or broadcast to all of them. The CS has a  
10 plurality of switches. When CS 0 is set broadcast is enabled allowing sound  
11 communication with all devices. When CS 0 is not set communication is selectively  
12 controlled by the other CS switches . For instance, when CS 1 is set sound  
13 communication with the first display unit is enabled, otherwise, it is disabled.

14 ~~One example of the invention~~ One preferred embodiment and several variations of  
15 ~~the invention device~~ have been described here in detail to comply with the Patent Statutes  
16 and to prove that this device could be constructed by one skilled in the arts. It is  
17 emphasized that numerous other implementations of the invention are possible, none of  
18 which depart from the scope of the invention itself. These include, but are not limited to:  
19 utilizing similar or different implementation technologies; utilizing similar or different  
20 implementation details; customizing for one or more different sports; utilizing more or  
21 fewer device states; utilizing other display technologies; utilizing other configuration

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1 devices technologies, and utilizing physically larger or smaller devices. ~~utilizing~~  
2 ~~multiple independent devices simultaneously on the athletic field; utilizing devices which~~  
3 ~~are carried by the athletes or attached to athletic equipment; utilizing remote control of~~  
4 ~~multiple devices which all display the same state; utilizing remote control of multiple~~  
5 ~~devices which display different states; providing in addition to the display of device state~~  
6 ~~information the relaying of communications from coaches, referees, and/or other players.~~

1 CLAIMS

2  
3  
4  
5 ~~1. A device and process for introducing state changes in athletic activities which~~  
6 ~~comprises:~~  
7 ~~(a) A battery powered electronic device in a suitably durable casing which contains an~~  
8 ~~embedded microprocessor based controller utilizing a program loaded from read only~~  
9 ~~memory to maintain multiple internal logical states whose combined values define the~~  
10 ~~device state. The controller and its program provide: a means for reading the device~~  
11 ~~settings from switches and dials interfaced to the controller; a means for varying the~~  
12 ~~device state over time; a means for selecting either periodic or randomly timed transitions~~  
13 ~~between device states; a means for generating (pseudo)random numbers; a means for~~  
14 ~~selecting either periodic or randomly timed transitions between device states; a means for~~  
15 ~~selecting either ordered or random progression through the available device states; a~~  
16 ~~means for varying the mean transition frequency between device states; a means for~~  
17 ~~varying the hold time (the minimum time a device state is maintained); a means for~~  
18 ~~varying the relative mean time spent in each device state (device state occupancy); and a~~  
19 ~~means for displaying the device state on sets of colored light emitting diodes (LEDs)~~  
20 ~~interfaced to the controller, for transmission to the athletes.~~

- 1 ~~(b) The process which comprises one or more athletes reading the device state~~  
2 ~~information from the display of one or more of the devices in (a) and interpreting this~~  
3 ~~information within the environment of an athletic training session or an actual game as a~~  
4 ~~local or global change in that environment. Example of a local change: pass the ball to the~~  
5 ~~left of this device. Example of a global change: goal shots are now allowed.~~
- 6 ~~(c) The device of (a) where the controller and/or display means are mechanical.~~
- 7 ~~(d) The device of (a) where the controller and/or display means are electromechanical.~~
- 8 ~~(e) The device of (a) where the controller is electrical.~~
- 9 ~~(f) The device of (a) where the controller is built from electronic components other than a~~  
10 ~~microprocessor.~~
- 11 ~~(g) The device of (a) where the local dials and switches are supplemented or replaced by a~~  
12 ~~separate remote control which sends device settings to the controller, which in turn stores~~  
13 ~~and maintains these settings until they are once again changed by the remote control.~~
- 14 ~~(h) The device of (a) where the periodic signals are generated by an oscillator external to~~  
15 ~~the controller.~~
- 16 ~~(i) The device of (a) where the generation of random numbers and/or time points is~~  
17 ~~accomplished by measuring physical processes (shot noise, radioactive decay, etc.)~~
- 18 ~~(j) The device of (a) where the device state is displayed to the athletes by optically active~~  
19 ~~devices other than LEDs, including, but not restricted to, liquid crystal displays, cathode~~  
20 ~~ray tubes, and fluorescent and incandescent bulbs.~~

1 ~~(k) The device of (a) where the device state is presented to the athletes on an~~

2 ~~alphanumeric ("Pass on left") or symbolic (an arrow pointing left) display.~~

3 ~~(l) The device of (a) where the device state is transmitted to the athletes as one or more~~

4 ~~simple sounds (bells, beeps, buzzes and the like, singly or in combination, simultaneously~~

5 ~~or in sequence.)~~

6 ~~(m) The device of (a) where the device state is transmitted to the athletes as a synthesized~~

7 ~~sound including especially synthesized speech.~~

8 ~~(n) The device of (a) where the device state is transmitted to the athletes as a recorded~~

9 ~~sound including especially recorded speech.~~

10 ~~(o) The device of (a) where the device state is transmitted to a receiver worn by the~~

11 ~~athlete, attached to an article of athletic apparel or equipment, or simply carried by the~~

12 ~~athlete, which displays the device state information for the athlete as in (a) and (j)~~

13 ~~through (n).~~

14 ~~(p) The device of (a) where the controller means are physically separate from, and distant~~

15 ~~from, the display means, with communications between the two parts via wire, fiber~~

16 ~~optics, electromagnetic radiation, or sound waves. Example: multiple devices distributed~~

17 ~~around a large field all displaying the same game state information sent from a single~~

18 ~~controller.~~

19 ~~(q) The device of (p) where different portions of the device state (here referring to the~~

20 ~~device composed of the controller and all remote displays) are presented on specific~~

- 1 ~~remote display units. Example: multiple goals in a complex field game are set~~  
2 ~~individually to indicate whether or not a shot on that goal is allowed.~~
- 3 ~~(r) The device of (p) where multiple remote display units are activated sequentially in a~~  
4 ~~predefined or randomly selected order so as to present a localized device state change that~~  
5 ~~moves in a one, two, or three dimensional pattern across a playing area. Example: an~~  
6 ~~athlete on a field containing numerous soccer cones incorporating the display moves to~~  
7 ~~“guard” the single active cone, where the order in which the cones are lit simulates the~~  
8 ~~motions of a moving offensive player.~~
- 9 ~~(s) The device (p) where communications from a coach, referee, or other player are~~  
10 ~~relayed through the field devices along with the device state to the display units, and~~  
11 ~~where such communications may be selectively targeted to any subset of the devices or~~  
12 ~~broadcast to all of them. Example: a coach seated high in a stadium first broadcasts a~~  
13 ~~message to all players to begin a different type of drill and then directs comments to~~  
14 ~~individual players during the course of that drill.~~
- 15 ~~(t) The devices of (a) through (s) where battery power is supplemented by or replaced~~  
16 ~~with solar power and/or line power.~~



1 ABSTRACT OF THE DISCLOSURE

2 ~~A device is described which has means to define and maintain different internal~~  
3 ~~states, means to transition at regular or random intervals between those states, means to~~  
4 ~~vary the minimum hold time in each state, means to vary the average time spent in each~~  
5 ~~state, means to vary the order in which the states are visited, and means to externalize and~~  
6 ~~transmit or display the internal state. Subsequently one or more athletes receive this~~  
7 ~~information and react to it as a change in their athletic training or game environment.~~

8 A device is described for introducing variation in athletic training and competitive  
9 events. This device maintains an internal state which occupies one of several allowed  
10 values. Depending upon the selected configuration, the device changes internal state at  
11 regular or irregular intervals, progresses through its allowed values sequentially or in  
12 random order, and spends a different designated fraction of time in each state. This  
13 variable and typically unpredictable state is transmitted or presented to the field of play  
14 where one or more athletes receive the information and react to it as a change in their  
15 athletic training or game environment. One form of the device coordinates multiple  
16 independent displays so that the signal corresponding to the internal state appears to move  
17 from display to display across the field of play.